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(54) Rotary hammer

(57) A rotary hammer with a hammer housing and a hammer mechanism provided therein has a tool holder (40) releasably fitted onto the front section of the hammer spindle (6) for receiving a hammer bit (41) with limited axial movement and non-rotatably. Arranged coaxially with respect to the section of the hammer spindle is a drill spindle (30), beyond the front end of which the section of the hammer spindle (6) receiving the tool holder (40) projects, and to which a drill chuck (42) for receiving an insert tool without axial displacement can be releasably and non-rotatably attached. The drill spindle (30) is driven by an additional rotary drive which operates when the electric motor is actuated, and the rotational speed of the drill spindle (30) is higher than the rotational speed of the hammer spindle (6) .

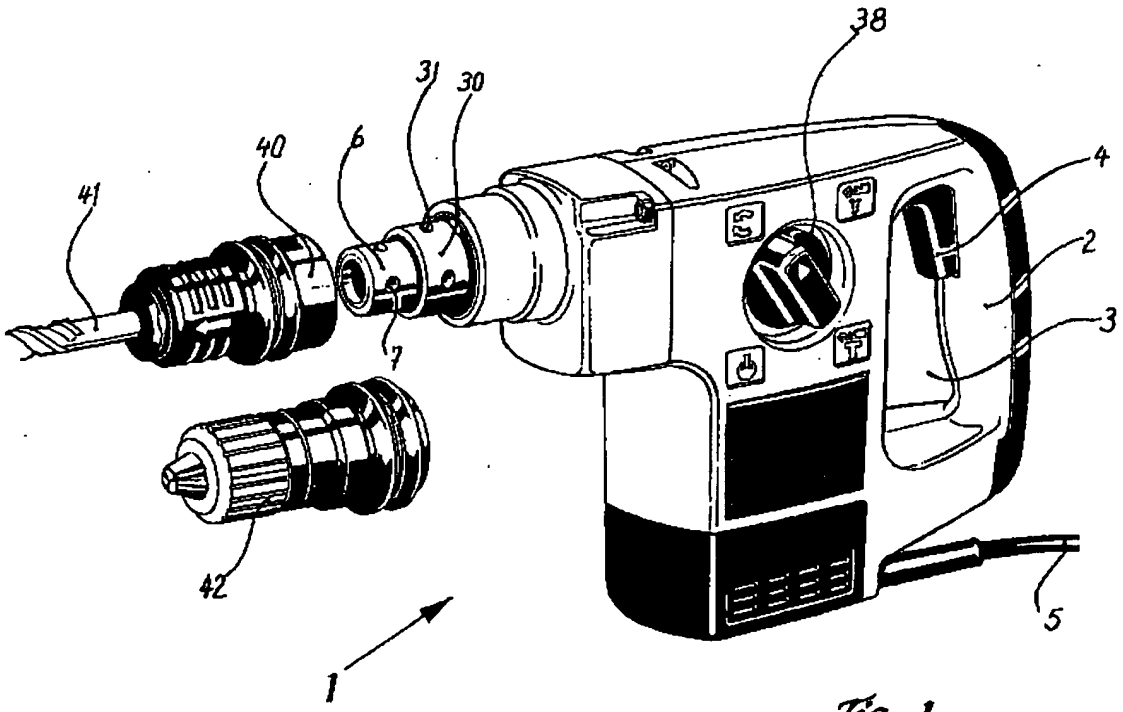

Fig. 1

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Description

The invention relates to a rotary hammer with a hammer housing, an electric motor provided in the hammer housing, a tool holder releasably and non-rotatably mounted at the front end of the hammer housing on a section of the hammer spindle, for receiving limitedly axially movably but non-rotatably a hammer bit, a hammer mechanism provided in the hammer housing for generating impacts acting on the rear end of a hammer bit inserted into the tool holder, and a rotary drive for the hammer spindle.

Rotary hammers of this kind, in which the tool holder can easily be removed by the user from the rotary hammer and replaced by another tool holder, are known in the most varied forms (U.S. Patent No. 5 199 833, German Patent No. 36 02 772, German Patent No. 40 10 239, German Patent Application 41 00 186, European Patent No. 0 265 380). This quick exchangeability of a tool holder on a rotary hammer makes it possible for example to replace the tool holder provided for the hammer bit, which normally receives the latter non-rotatably yet limitedly movably back and forth in an axial direction, but does not grip it precisely coaxially with respect to the axis of rotation of the tool holder, with a tool holder which is designed in the manner of a drill chuck with clamping jaws into which a drill bit with a round shaft can be clamped for pure drilling and held exactly coaxial to the axis of rotation of the drill chuck in drilling mode. If therefore the hammer mechanism is rendered inactive when the drill chuck is fitted, precise drilling can also be carried out with such a rotary hammer because the drill bit used for that purpose is clamped tight in exact alignment in the drill chuck.

In order to carry out pure drilling work and optionally also to use such a rotary hammer as a screwdriver, it is desired in many cases to drive the drill chuck at a higher rotational speed than the rotational speed at which the tool holder receiving a hammer bit is rotated at a maximum in hammer-drilling mode. This can be achieved for example by providing the rotary hammer with a gear change mechanism which, in a first position, causes the hammer spindle to rotate at a lower rotational speed suitable for hammer-drilling mode while, in a second position, it causes the hammer spindle to rotate at a higher rotational speed, as is advantageous for the desired drilling and screwing operations. In the case of rotary-hammer operation, however, this higher rotational speed would result in damage to the hammer bit and rotary hammer and could possibly even cause danger to the user. However, in the case of such a structure with gear change mechanism the danger exists that the user will forget, after removing the drill chuck and fitting the tool holder for hammer-drilling mode, to switch the rotary hammer over into the position for operation at lower speed, thereby giving rise to the above-explained dangers.

It is the object of the invention to improve a rotary hammer in such a way that, in addition to operating with a tool holder, it can operate, by means of a change which is easy for the user to carry out, as a drill and/or screwdriver at a higher speed than in hammer-drilling mode, without there existing the danger that the user will also use the higher speed for rotary-hammer mode.

In order to achieve this object, a rotary hammer of the type mentioned at the outset is designed according to the invention in such a way that there is arranged coaxially with respect to said section of the hammer spindle a drill spindle, beyond the front end of which said section of the hammer spindle receiving the tool holder projects, and to which a drill chuck for axially non-displaceably receiving an insert tool can be releasably and non-rotatably attached, that the drill spindle is driven by an additional rotary drive which is effective when the electric motor is actuated, and that the rotational speed of the drill spindle is higher than the rotational speed of the hammer spindle. The gear wheel forming part of the additional rotary drive and non-rotatably connected to the drill spindle is preferably arranged axially in front of the gear wheel forming part of the rotary drive and non-rotatably connected to the hammer spindle.

In addition to the hammer spindle, the rotary hammer according to the invention thus has a drill spindle which rotates continuously when the rotary hammer is in operation, which drill spindle surrounds the hammer spindle and the front end of which is set back somewhat vis-à-vis the section receiving the tool holder, usually the front end of the hammer spindle. Therefore, in order to switch from rotary-hammer mode to drilling or screwdriving mode, the user can remove the tool holder for hammer bits from the hammer spindle in the usual manner and then fit onto the drill spindle a drill chuck, the inner width of which, in the region of the connection to the drill spindle, is greater than the outer diameter of the hammer spindle, so that the creation of a connection between drill chuck and hammer spindle is avoided with certainty. Accordingly, owing to its smaller inner width in the receiving area, the tool holder for hammer bits cannot, of course, also not be fitted onto the drill spindle. It is therefore ensured that the user can connect tool holder and drill chuck only to the spindles provided for them, and therefore in particular does not inadvertently couple the drill spindle, intended to receive the drill chuck and rotating at a higher speed than the hammer spindle, to the tool holder for hammer bits.

It is also already known (German Patent No. 1 251 131) in the case of a handheld power drill to provide two coaxially arranged drill spindles, of which the inner one projects with its outer or front end beyond the outer one, and both drill spindles are driven in continuous rotation when the drill is in operation. The differently dimensioned drill chucks which can be connected to the different drill spindles serve to receive drill bits having differently sized diameters. The outer drill spindle, adapted to drive the drill chuck for greater drill bit diameters, is driven at a lower rotational speed than the inner drill

spindle. Moreover, in the case of this known drill, the outer drill spindle is driven by the inner drill spindle via a gear wheel arrangement, i.e., it is for example not possible to drive the outer drill spindle alone continuously in rotation when the drill is in operation without simultaneously driving the inner drill spindle.

The known drill differs fundamentally from the rotary hammer according to the invention not only in the fact that the rotary hammer according to the invention has a hammer mechanism which cooperates with the inner spindle or hammer spindle and that, in the case of the rotary hammer according to the invention, completely different types of tool holders, namely a tool holder for a hammer bit on the one hand and a drill chuck for a round shaft drill bit or a screwdriver insert on the other hand, are used whereas, in the case of the known drill, drill chucks of the same kind differing only in size are used, but in particular in the fact that, in the case of the known drill, the arrangement serves only to drive differently sized drill bits at different speeds without, for example, the insertion of a drill bit of one size into the drill chuck of the other size resulting in an operating situation endangering the drill bit, the drill chuck and/or the operator. In contrast, in the case of the rotary hammer according to the invention a problem is solved, not occurring at all in the case of the known drill, of coupling tool holders designed for different operating modes, namely hammer drilling and chiselling on the one hand and pure drilling or screwdriving on the other hand, which tool holders are rotated at different speeds in operation, to the rotary hammer in such a way that a wrong connection, which may result in great damage to a hammer bit and the rotary hammer and in danger to the operator, is avoided with certainty.

In the rotary hammer according to the invention, the gear wheels of rotary drive and of additional rotary drive driving the hammer spindle and the drill spindle, respectively, may be arranged on a common intermediate shaft, whereby the rotary movement of the armature shaft of the electric motor can easily be transmitted to the rotary drives.

Furthermore, in the rotary hammer, the rotary drive may be deactivated so that the rotary hammer operates in pure hammer or chiselling mode, while the drill spindle continues to be driven in rotation.

The invention is explained in more detail below with reference to the figures which schematically show an embodiment.

Figure 1 shows a rotary hammer with a tool holder separate from it and a drill chuck separate from it.

Figure 2 shows, in a partial representation, the rotary drives and the spindles of the rotary hammer as well as the tool holder and the drill chuck.

Figure 3 shows, in a simplified partial section, details of the structure according to Figure 2.

The rotary hammer 1 represented in Figure 1 has in the usual manner a housing, the rear area of which forms a handle section 2, between which and the remaining housing a handle opening 3 is formed into which the trigger element 4 for the on/off switch of the rotary hammer 1 projects. In the lower part of the housing a cable 5 to connect the rotary hammer to a power source runs into the rotary hammer housing and is wired there with its electrical conductors in conventional manner in order to apply voltage to the electric motor 21 in the usual manner upon corresponding actuation of the on/off switch, so that its armature shaft 22 rotates. The front end of the hammer spindle 6 projects from the front end of the housing of the rotary hammer 1 and has in its outer circumferential area locking recesses 7 onto which the tool holder 40 can be releasably but non-rotatably and axially non-displaceably fixed in a known manner by means of corresponding locking balls (not shown) which are movable in the axial direction against spring pressure. The tool holder 40 serves to receive hammer bits 41 which are mounted in the tool holder non-rotatably, but limitedly axially movably for hammer operation. This can be, for example, a so-called SDS plus hammer bit, as is generally known.

Also projecting beyond the front end of the housing of the rotary hammer 1 is the front end of a drill spindle 30 which coaxially surrounds the hammer spindle 6, but is somewhat set back vis-à-vis the front end of the hammer spindle 6 or ends spaced from the front end of the hammer spindle 6. Also provided in the outer circumferential area of the front end of the drill spindle 30 are locking recesses 31 which cooperate with locking balls, not shown, in the drill chuck 42, so that the drill chuck 42 can easily be fitted releasably, but non-rotatably and axially non-displaceably, onto the drill spindle 30 when the tool holder 40 is removed. The drill chuck 42 is designed in the manner of a customary jaw chuck for receiving and clamping drill bits with a round shaft and/or screwdriver inserts 43.

As can be seen in particular in Figure 3, with its extended rear end-area the hammer spindle 6 also forms a guide tube for a hollow piston 8, conventional for pneumatic hammer mechanisms in rotary hammers, in which a ram 9 is arranged axially movably. The hollow piston 8 is moved back and forth in the usual manner when in operation by a wobble plate drive, the wobble plate 11 of which has a wobble finger 12 which extends into a pivot pin 13 rotatably mounted in the rear end-area of the hollow piston 8. When the support bush for the wobble plate 11 is rotated, the hollow piston 8 is therefore moved back and forth, whereby the ram 9 is moved back and forth in a manner known for pneumatic hammer mechanisms of such rotary hammers by the alternating build-up of above-atmospheric pressure and below-atmospheric pressure in the area between the rear end of the ram 9 and the bottom of the hollow piston 8, so that on moving forwards it strikes the rear end of a beat piece 10 which transmits this impact onto the rear end of a hammer bit 41 inserted into the tool holder 40.

The support bush for the wobble plate 11 is arranged rotatably on an intermediate shaft 17 extending

parallel to the longitudinal axis of the hammer spindle 8 and is coupled to the intermediate shaft 17 via a non-rotatable coupling sleeve, seated on it but able to be disengaged from the support bush against the force of a pressure spring, which coupling sleeve is designed in one piece with a flange area 14. A switching device, not shown, actuatable from outside by a rotary knob 38 (Figure 1), acts upon the flange area 14 in a known manner, in order to uncouple the wobble plate 11 from the rotatingly driven intermediate shaft 17 and thereby to interrupt the drive for the hammer mechanism. For its drive, the intermediate shaft 17 non-rotatably supports a bevel gear 25 which meshes with a pinion 23 provided on the outer end of the armature shaft 22 of the electric motor 21, so that the intermediate shaft 17 is driven rotatingly on rotation of the armature shaft 23. Sitting non-rotatably and axially non-displaceably on the intermediate shaft 17 is a gear wheel 15 which cooperates with a gear wheel 26 non-rotatably but axially movably mounted on the hammer spindle 6. In the position of the gear wheel 26 shown in Figure 3, the hammer spindle 8, which is housed in bearings 32 and 33 rotatably in the drill spindle 30 and in a bearing 27 rotatably in an inner housing part 20', is rotatingly driven on rotation of the intermediate shaft 17 so that the tool holder 40 optionally attached to it and the hammer bit sitting in it are also rotatingly driven.

The gear wheel 26 can be displaced axially forwards on the hammer spindle 6 by action of the switching mechanism, not shown and actuatable by the rotary knob 38 in Figure 1. Through this displacement along the hammer spindle 6, the gear wheel 26 is disengaged from the gear wheel 15 into the position shown in Figure 2, and the rotary drive for the hammer spindle 6 is interrupted, i.e. the rotary hammer operates in pure hammer or chiselling mode, as is known and customary in the case of such rotary hammers.

Located close to the front bearing 19 of the intermediate shaft 17 is another gear wheel 18 which is non-rotatably and axially non-displaceably mounted on the intermediate shaft 17 and which meshes with a gear wheel 35 which is non-rotatably attached to the drill spindle 30 closer to the front end of the hammer spindle 6 than its gear wheel 26. The drill spindle 30 is rotatably housed in the inner housing 20 by means of a bearing 34 and, as already mentioned, coaxially surrounds the hammer spindle 6. The front end of the drill spindle 30 is at a distance from the front end of the hammer spindle 6, whereas the gear wheel 35 lying in front of the gear wheel 26 is attached to the rear end of the drill spindle 30. The drill spindle 30 is driven on rotation of the intermediate shaft 17 by the gear wheel 18. Since gear wheel 18 and gear wheel 35 are always engaged with each other, the drill spindle 30 rotates whenever the electric motor 21 drives the intermediate shaft 17. The rotational speed of the drill spindle 30 is higher than that of the hammer spindle 6 and is selected in such a way that the desired drilling and/or screwdriving operations can be carried out with it in the usual manner.

If the user removes the tool holder 40 from the hammer spindle 6, he can fit the drill chuck 42 onto the front end of the drill spindle 30 in a non-rotatable and axially non-movable manner, the section of the hammer spindle 6 projecting beyond the front end of the drill spindle 30 extending into an appropriately expanded area of the drill chuck 42, therefore impairing neither the fitting of the drill chuck 42 onto the drill spindle 30 nor their cooperation.

Claims

1. A rotary hammer comprising:

   (i) a hammer housing,
   (ii) an electric motor (21) provided in the hammer housing,
   (iii) a tool holder (40) mounted at the front end of the hammer housing releasably and non-rotatably on a section of the hammer spindle (6), for receiving a hammer bit (41) with limited axial movement but not rotatably therein,
   (iv) a hammer mechanism provided in the hammer housing for generating impacts acting on the rear end of a hammer bit (41) inserted into the tool holder (40), and
   (v) a rotary drive (15, 26) for the hammer spindle (6),

   characterised in that

   there is arranged coaxially with respect to the section of the hammer spindle (6) a drill spindle (30), beyond the front end of which the section of the hammer spindle (6) receiving the tool holder (40) projects, and to which a drill chuck (42) for receiving an insert tool (43) without axial displacement can be releasably and non-rotatably attached,
   the drill spindle (30) is driven by an additional rotary drive (18, 35) which operates when the electric motor (21) is actuated, and the rotational speed of the drill spindle (30) is higher than the rotational speed of the hammer spindle (6).

2. A rotary hammer according to claim 1, the gear wheels (15, 18) of rotary drive (15, 26) and of additional rotary drive (18, 35) driving the hammer spindle (6) and the drill spindle (30), respectively, are arranged on a common intermediate shaft (17).

3. A rotary hammer according to claim 1 or 2, wherein the gear wheel (35) forming part of the additional rotary drive (18, 35) and non-rotatably connected to the drill spindle (30) is arranged axially in front of the gear wheel (26) forming part of the rotary drive

(15, 26) and non-rotatably connected to the hammer spindle (6).

4. A rotary hammer according to any one of claims 1 to 3, wherein the rotary drive (15, 26) can be deactivated to obtain pure hammer mode.

5. A rotary hammer comprising:

(i) a hammer housing
(ii) an electric motor (21) provided in the hammer housing,
(iii). a tool holder (40) mounted at the front end of the hammer housing releasably and non-rotatably on a section of the hammer spindle (6), for receiving a hammer bit (41) with limited axial movement but not rotatably therein,
(iv) a rotary drive (15, 26) for the hammer spindle (6), which operates on a gear wheel (26) non-rotatably attached to the hammer spindle,
(v) a hammer mechanism provided in the hammer housing for generating impacts acting on the rear end of a hammer bit (41) inserted into the tool holder (40),
(vi) a drill spindle (30), arranged coaxially with respect to the section of the hammer spindle (6), beyond the front end of which the section of the hammer spindle (6) receiving the tool holder (40) projects, and to which a drill chuck (42) for receiving an insert tool (43) without axial displacement can be releasably and non-rotatably attached,
(vii) an additional rotary drive (18, 35) for the drill spindle (30), which is operates when the electric motor is actuated and which rotates the drill spindle (30) at a high rotational speed than the rotational speed of the hammer spindle (6), and
(viii) a gear wheel (35), non-rotatably attached to the drill spindle (30), on which the additional rotary drive (18, 35) acts and which is arranged axially in front of the gear wheel (26) attached to the hammer spindle (6).

6. A rotary hammer according to claim 5, wherein the gear wheels (15, 18) of rotary drive (15, 26) and of additional rotary drive (18, 35) co-operating with the gear wheels (26, 35) on hammer spindle (6) and drill spindle (30) are arranged on a common intermediate shaft (17).

7. A rotary hammer according to claim 5 or 6, wherein the rotary drive (15, 26) can be deactivated to obtain pure hammer mode.

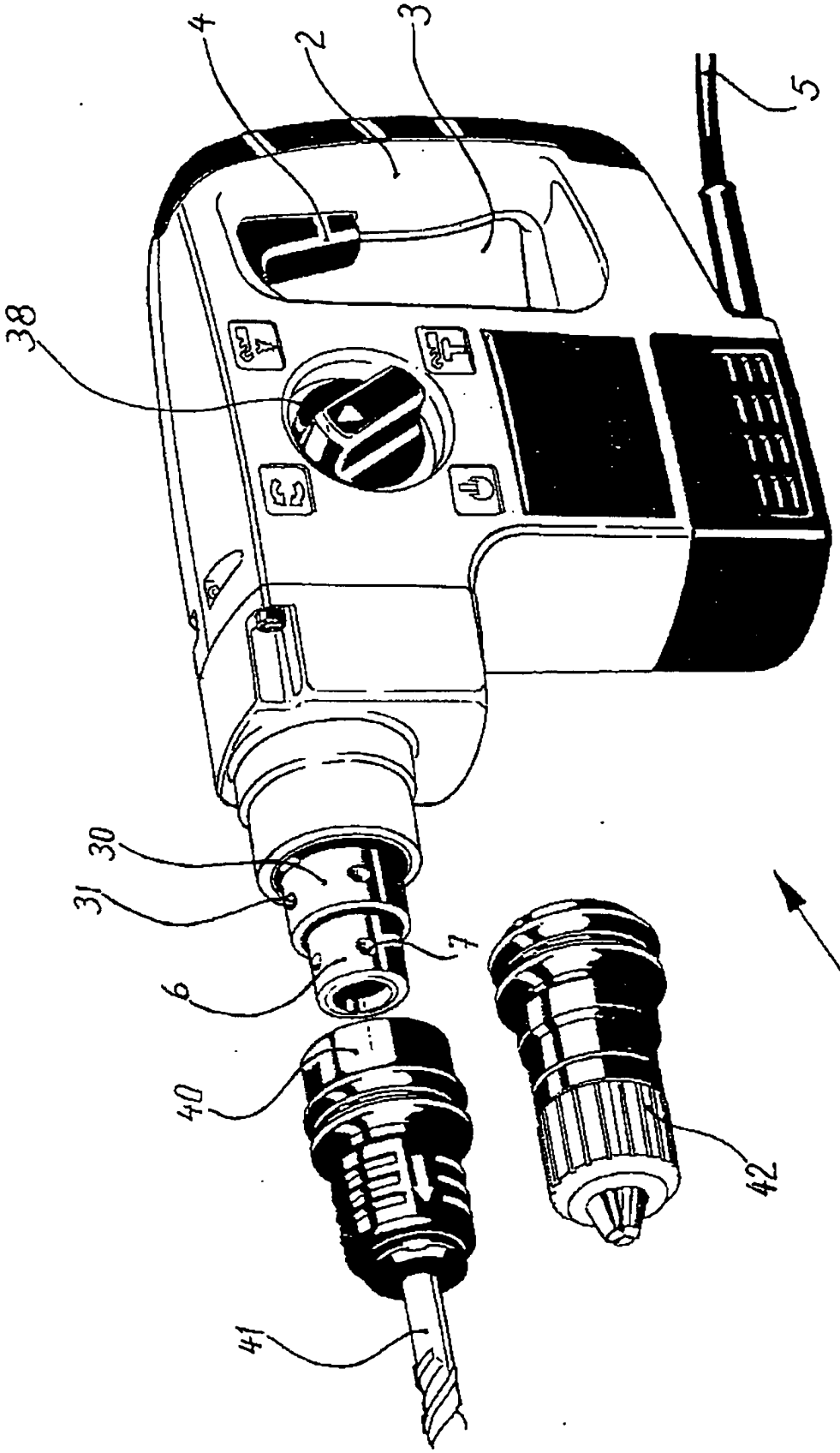

Fig. 1

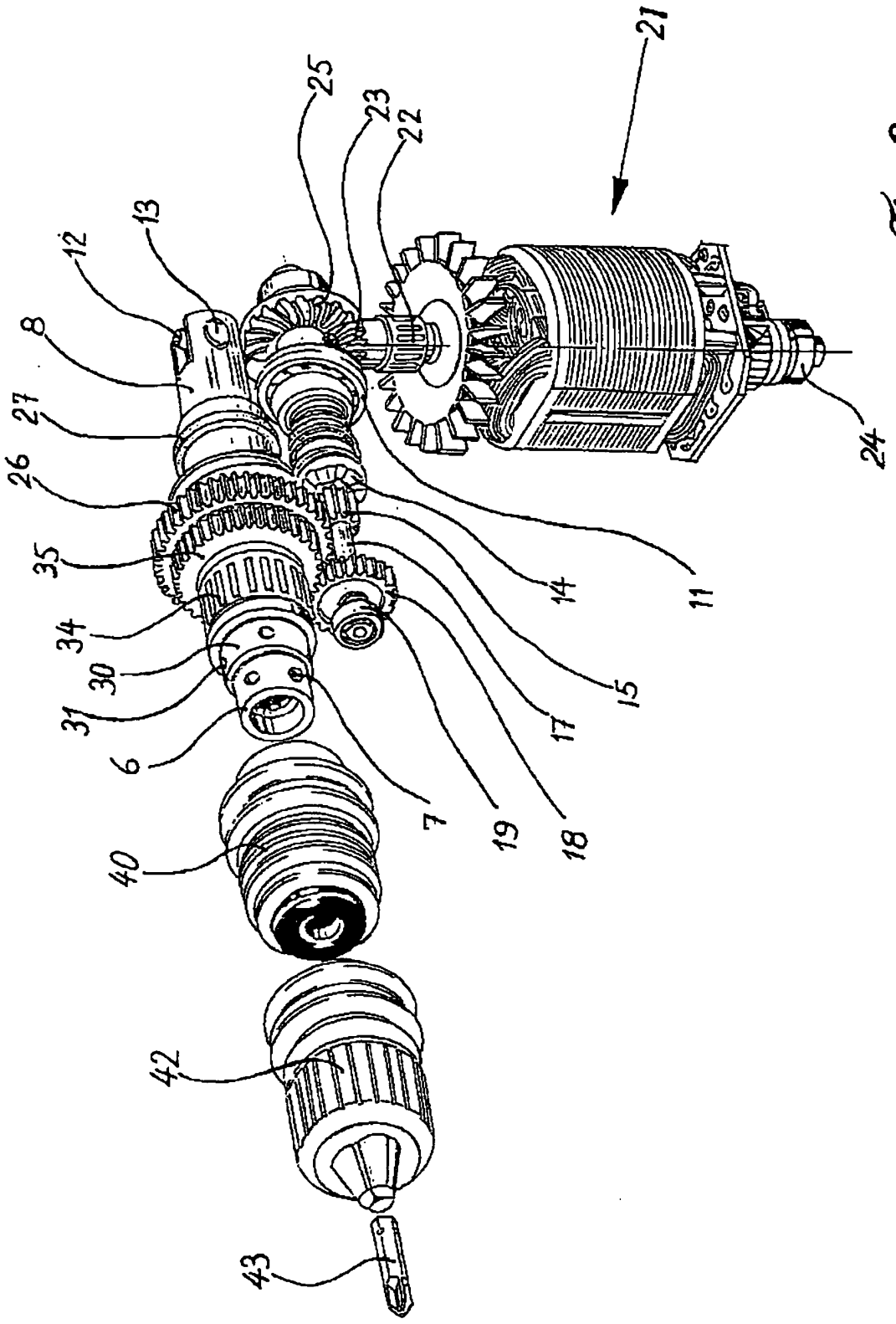

Fig. 2

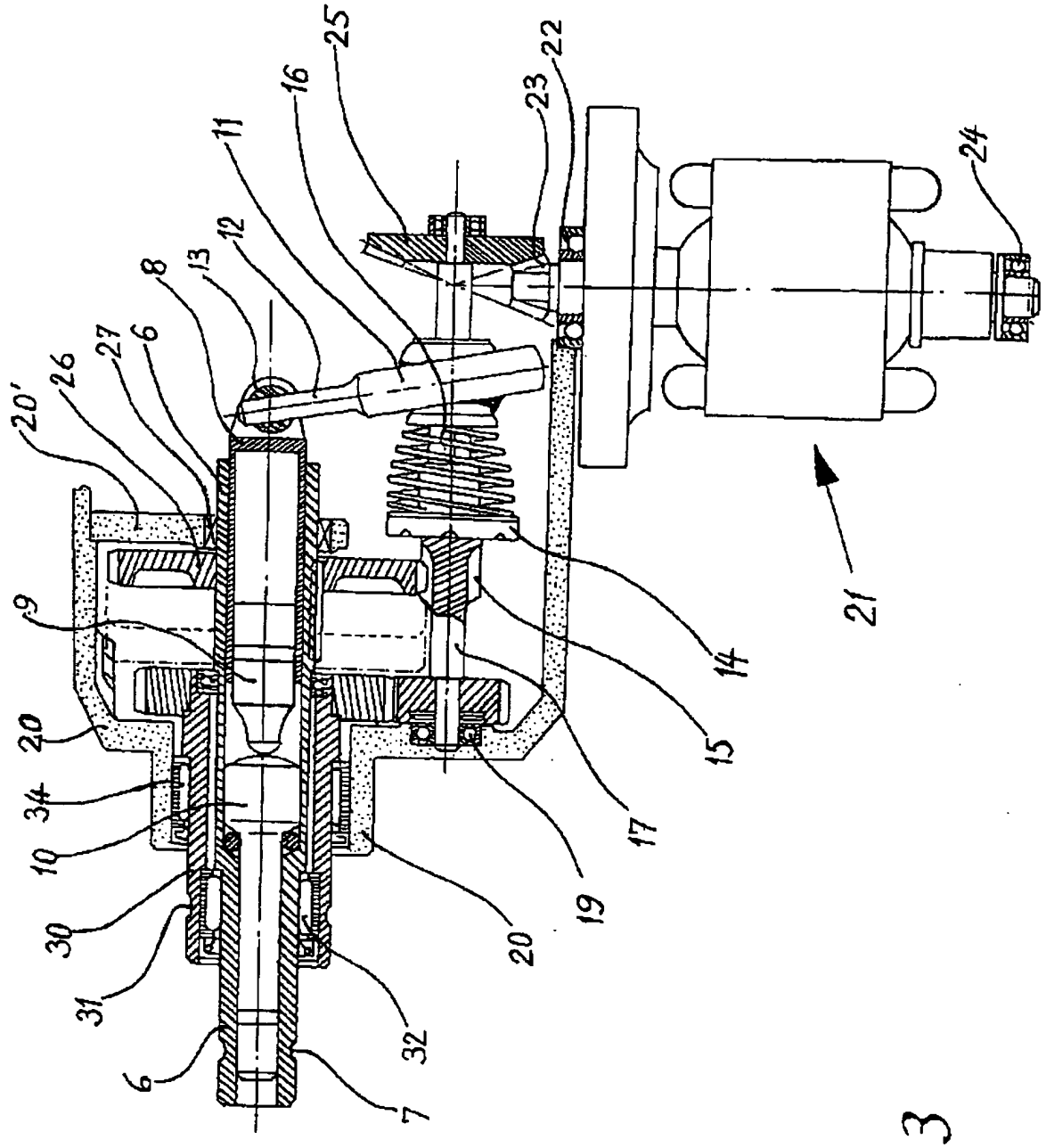
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Fig. 3

European Patent Office

EUROPEAN SEARCH REPORT

Application Number
EP 98 30 5568

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int.Cl.6)
A,D	DE 41 00 186 A (BOSCH GMBH ROBERT) 9 July 1992 * abstract; figure 1 *	1,5	B23B45/00 B23B45/02

TECHNICAL FIELDS SEARCHED (Int.Cl.6)

B23B

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
MUNICH	19 November 1998	Fischer, M

CATEGORY OF CITED DOCUMENTS

X : particularly relevant if taken alone
Y : particularly relevant if combined with another document of the same category
A : technological background
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T : theory or principle underlying the invention
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EPO FORM 1503 03.82 (P04C01)

Description

[0001] The invention relates to a rotary hammer with a hammer housing, an electric motor provided in the hammer housing, a tool holder releasably and non-rotatably mounted at the front end of the hammer housing on a section of the hammer spindle, for receiving limitedly axially movably but non-rotatably a hammer bit, a hammer mechanism provided in the hammer housing for generating impacts acting on the rear end of a hammer bit inserted into the tool holder, and a rotary drive for the hammer spindle.

[0002] Rotary hammers of this kind, in which the tool holder can easily be removed by the user from the rotary hammer and replaced by another tool holder, are known in the most varied forms (U.S. Patent No. 5 199 833, German Patent No. 36 02 772, German Patent No. 40 10 239, German Patent Application 41 00 186, European Patent No. 0 265 380). This quick exchangeability of a tool holder on a rotary hammer makes it possible for example to replace the tool holder provided for the hammer bit, which normally receives the latter non-rotatably yet limitedly movably back and forth in an axial direction, but does not grip it precisely coaxially with respect to the axis of rotation of the tool holder, with a tool holder which is designed in the manner of a drill chuck with clamping jaws into which a drill bit with a round shaft can be clamped for pure drilling and held exactly coaxial to the axis of rotation of the drill chuck in drilling mode. If therefore the hammer mechanism is rendered inactive when the drill chuck is fitted, precise drilling can also be carried out with such a rotary hammer because the drill bit used for that purpose is clamped tight in exact alignment in the drill chuck.

[0003] In order to carry out pure drilling work and optionally also to use such a rotary hammer as a screwdriver, it is desired in many cases to drive the drill chuck at a higher rotational speed than the rotational speed at which the tool holder receiving a hammer bit is rotated at a maximum in hammer-drilling mode. This can be achieved for example by providing the rotary hammer with a gear change mechanism which, in a first position, causes the hammer spindle to rotate at a lower rotational speed suitable for hammer-drilling mode while, in a second position, it causes the hammer spindle to rotate at a higher rotational speed, as is advantageous for the desired drilling and screwing operations. In the case of rotary-hammer operation, however, this higher rotational speed would result in damage to the hammer bit and rotary hammer and could possibly even cause danger to the user. However, in the case of such a structure with gear change mechanism the danger exists that the user will forget, after removing the drill chuck and fitting the tool holder for hammer-drilling mode, to switch the rotary hammer over into the position for operation at lower speed, thereby giving rise to the above-explained dangers.

[0004] It is the object of the invention to improve a rotary hammer in such a way that, in addition to operating with a tool holder, it can operate, by means of a change which is easy for the user to carry out, as a drill and/or screwdriver at a higher speed than in hammer-drilling mode, without there existing the danger that the user will also use the higher speed for rotary-hammer mode.

[0005] In order to achieve this object, a rotary hammer of the type mentioned at the outset is designed according to the invention in such a way that there is arranged coaxially with respect to said section of the hammer spindle a drill spindle, beyond the front end of which said section of the hammer spindle receiving the tool holder projects, and to which a drill chuck for axially non-displaceably receiving an insert tool can be releasably and non-rotatably attached, that the drill spindle is driven by an additional rotary drive which is effective when the electric motor is actuated, and that the rotational speed of the drill spindle is higher than the rotational speed of the hammer spindle. The gear wheel forming part of the additional rotary drive and non-rotatably connected to the drill spindle is preferably arranged axially in front of the gear wheel forming part of the rotary drive and non-rotatably connected to the hammer spindle.

[0006] In addition to the hammer spindle, the rotary hammer according to the invention thus has a drill spindle which rotates continuously when the rotary hammer is in operation, which drill spindle surrounds the hammer spindle and the front end of which is set back somewhat vis-à-vis the section receiving the tool holder, usually the front end of the hammer spindle. Therefore, in order to switch from rotary-hammer mode to drilling or screwdriving mode, the user can remove the tool holder for hammer bits from the hammer spindle in the usual manner and then fit onto the drill spindle a drill chuck, the inner width of which, in the region of the connection to the drill spindle, is greater than the outer diameter of the hammer spindle, so that the creation of a connection between drill chuck and hammer spindle is avoided with certainty. Accordingly, owing to its smaller inner width in the receiving area, the tool holder for hammer bits cannot, of course, also not be fitted onto the drill spindle. It is therefore ensured that the user can connect tool holder and drill chuck only to the spindles provided for them, and therefore in particular does not inadvertently couple the drill spindle, intended to receive the drill chuck and rotating at a higher speed than the hammer spindle, to the tool holder for hammer bits.

[0007] It is also already known (German Patent No. 1 251 131) in the case of a handheld power drill to provide two coaxially arranged drill spindles, of which the inner one projects with its outer or front end beyond the outer one, and both drill spindles are driven in continuous rotation when the drill is in operation. The differently dimensioned drill chucks which can be connected to the different drill spindles serve to receive drill bits having differently sized diameters. The outer drill spindle, adapted to drive the drill chuck for greater drill bit diameters, is driven at a lower rotational speed than the inner

drill spindle. Moreover, in the case of this known drill, the outer drill spindle is driven by the inner drill spindle via a gear wheel arrangement, i.e., it is for example not possible to drive the outer drill spindle alone continuously in rotation when the drill is in operation without simultaneously driving the inner drill spindle.

[0008] The known drill differs fundamentally from the rotary hammer according to the invention not only in the fact that the rotary hammer according to the invention has a hammer mechanism which cooperates with the inner spindle or hammer spindle and that, in the case of the rotary hammer according to the invention, completely different types of tool holders, namely a tool holder for a hammer bit on the one hand and a drill chuck for a round shaft drill bit or a screwdriver insert on the other hand, are used whereas, in the case of the known drill, drill chucks of the same kind differing only in size are used, but in particular in the fact that, in the case of the known drill, the arrangement serves only to drive differently sized drill bits at different speeds without, for example, the insertion of a drill bit of one size into the drill chuck of the other size resulting in an operating situation endangering the drill bit, the drill chuck and/or the operator. In contrast, in the case of the rotary hammer according to the invention a problem is solved, not occurring at all in the case of the known drill, of coupling tool holders designed for different operating modes, namely hammer drilling and chiselling on the one hand and pure drilling or screwdriving on the other hand, which tool holders are rotated at different speeds in operation, to the rotary hammer in such a way that a wrong connection, which may result in great damage to a hammer bit and the rotary hammer and in danger to the operator, is avoided with certainty.

[0009] In the rotary hammer according to the invention, the gear wheels of rotary drive and of additional rotary drive driving the hammer spindle and the drill spindle, respectively, may be arranged on a common intermediate shaft, whereby the rotary movement of the armature shaft of the electric motor can easily be transmitted to the rotary drives.

[0010] Furthermore, in the rotary hammer, the rotary drive may be deactivated so that the rotary hammer operates in pure hammer or chiselling mode, while the drill spindle continues to be driven in rotation.

[0011] The invention is explained in more detail below with reference to the figures which schematically show an embodiment.

[0012] Figure 1 shows a rotary hammer with a tool holder separate from it and a drill chuck separate from it.

[0013] Figure 2 shows, in a partial representation, the rotary drives and the spindles of the rotary hammer as well as the tool holder and the drill chuck.

[0014] Figure 3 shows, in a simplified partial section, details of the structure according to Figure 2.

[0015] The rotary hammer 1 represented in Figure 1 has in the usual manner a housing, the rear area of which forms a handle section 2, between which and the remaining housing a handle opening 3 is formed into which the trigger element 4 for the on/off switch of the rotary hammer 1 projects. In the lower part of the housing a cable 5 to connect the rotary hammer to a power source runs into the rotary hammer housing and is wired there with its electrical conductors in conventional manner in order to apply voltage to the electric motor 21 in the usual manner upon corresponding actuation of the on/off switch, so that its armature shaft 22 rotates. The front end of the hammer spindle 6 projects from the front end of the housing of the rotary hammer 1 and has in its outer circumferential area locking recesses 7 onto which the tool holder 40 can be releasably but non-rotatably and axially non-displaceably fixed in a known manner by means of corresponding locking balls (not shown) which are movable in the axial direction against spring pressure. The tool holder 40 serves to receive hammer bits 41 which are mounted in the tool holder non-rotatably, but limitedly axially movably for hammer operation. This can be, for example, a so-called SDS plus hammer bit, as is generally known.

[0016] Also projecting beyond the front end of the housing of the rotary hammer 1 is the front end of a drill spindle 30 which coaxially surrounds the hammer spindle 6, but is somewhat set back vis-à-vis the front end of the hammer spindle 6 or ends spaced from the front end of the hammer spindle 6. Also provided in the outer circumferential area of the front end of the drill spindle 30 are locking recesses 31 which cooperate with locking balls, not shown, in the drill chuck 42, so that the drill chuck 42 can easily be fitted releasably, but non-rotatably and axially non-displaceably, onto the drill spindle 30 when the tool holder 40 is removed. The drill chuck 42 is designed in the manner of a customary jaw chuck for receiving and clamping drill bits with a round shaft and/or screwdriver inserts 43.

[0017] As can be seen in particular in Figure 3, with its extended rear end-area the hammer spindle 6 also forms a guide tube for a hollow piston 8, conventional for pneumatic hammer mechanisms in rotary hammers, in which a ram 9 is arranged axially movably. The hollow piston 8 is moved back and forth in the usual manner when in operation by a wobble plate drive, the wobble plate 11 of which has a wobble finger 12 which extends into a pivot pin 13 rotatably mounted in the rear end-area of the hollow piston 8. When the support bush for the wobble plate 11 is rotated, the hollow piston 8 is therefore moved back and forth, whereby the ram 9 is moved back and forth in a manner known for pneumatic hammer mechanisms of such rotary hammers by the alternating build-up of above-atmospheric pressure and below-atmospheric pressure in the area between the rear end of the ram 9 and the bottom of the hollow piston 8, so that on moving forwards it strikes the rear end of a beat piece 10 which transmits this impact onto the rear end of a hammer bit 41 inserted into the tool holder 40.

[0018] The support bush for the wobble plate 11 is arranged rotatably on an intermediate shaft 17 extending

parallel to the longitudinal axis of the hammer spindle 8 and is coupled to the intermediate shaft 17 via a non-rotatable coupling sleeve, seated on it but able to be disengaged from the support bush against the force of a pressure spring, which coupling sleeve is designed in one piece with a flange area 14. A switching device, not shown, actuatable from outside by a rotary knob 38 (Figure 1), acts upon the flange area 14 in a known manner, in order to uncouple the wobble plate 11 from the rotatingly driven intermediate shaft 17 and thereby to interrupt the drive for the hammer mechanism. For its drive, the intermediate shaft 17 non-rotatably supports a bevel gear 25 which meshes with a pinion 23 provided on the outer end of the armature shaft 22 of the electric motor 21, so that the intermediate shaft 17 is driven rotatingly on rotation of the armature shaft 23. Sitting non-rotatably and axially non-displaceably on the intermediate shaft 17 is a gear wheel 15 which cooperates with a gear wheel 26 non-rotatably but axially movably mounted on the hammer spindle 6. In the position of the gear wheel 26 shown in Figure 3, the hammer spindle 8, which is housed in bearings 32 and 33 rotatably in the drill spindle 30 and in a bearing 27 rotatably in an inner housing part 20', is rotatingly driven on rotation of the intermediate shaft 17 so that the tool holder 40 optionally attached to it and the hammer bit sitting in it are also rotatingly driven.

[0019] The gear wheel 26 can be displaced axially forwards on the hammer spindle 6 by action of the switching mechanism, not shown and actuatable by the rotary knob 38 in Figure 1. Through this displacement along the hammer spindle 6, the gear wheel 26 is disengaged from the gear wheel 15 into the position shown in Figure 2, and the rotary drive for the hammer spindle 6 is interrupted, i.e. the rotary hammer operates in pure hammer or chiselling mode, as is known and customary in the case of such rotary hammers.

[0020] Located close to the front bearing 19 of the intermediate shaft 17 is another gear wheel 18 which is non-rotatably and axially non-displaceably mounted on the intermediate shaft 17 and which meshes with a gear wheel 35 which is non-rotatably attached to the drill spindle 30 closer to the front end of the hammer spindle 6 than its gear wheel 26. The drill spindle 30 is rotatably housed in the inner housing 20 by means of a bearing 34 and, as already mentioned, coaxially surrounds the hammer spindle 6. The front end of the drill spindle 30 is at a distance from the front end of the hammer spindle 6, whereas the gear wheel 35 lying in front of the gear wheel 26 is attached to the rear end of the drill spindle 30. The drill spindle 30 is driven on rotation of the intermediate shaft 17 by the gear wheel 18. Since gear wheel 18 and gear wheel 35 are always engaged with each other, the drill spindle 30 rotates whenever the electric motor 21 drives the intermediate shaft 17. The rotational speed of the drill spindle 30 is higher than that of the hammer spindle 6 and is selected in such a way that the desired drilling and/or screwdriving operations can be carried out with it in the usual manner.

[0021] If the user removes the tool holder 40 from the hammer spindle 6, he can fit the drill chuck 42 onto the front end of the drill spindle 30 in a non-rotatable and axially non-movable manner, the section of the hammer spindle 6 projecting beyond the front end of the drill spindle 30 extending into an appropriately expanded area of the drill chuck 42, therefore impairing neither the fitting of the drill chuck 42 onto the drill spindle 30 nor their cooperation.

Claims

1. A rotary hammer comprising:

   (i) a hammer housing,
   (ii) an electric motor (21) provided in the hammer housing,
   (iii) a tool holder (40) mounted at the front end of the hammer housing releasably and non-rotatably on a section of the hammer spindle (6), for receiving a hammer bit (41) with limited axial movement but not rotatably therein,
   (iv) a hammer mechanism provided in the hammer housing for generating impacts acting on the rear end of a hammer bit (41) inserted into the tool holder (40), and
   (v) a rotary drive (15, 26) for the hammer spindle (6),

   characterised in that

   there is arranged coaxially with respect to the section of the hammer spindle (6) a drill spindle (30), beyond the front end of which the section of the hammer spindle (6) receiving the tool holder (40) projects, and to which a drill chuck (42) for receiving an insert tool (43) without axial displacement can be releasably and non-rotatably attached,
   the drill spindle (30) is driven by an additional rotary drive (18, 35) which operates when the electric motor (21) is actuated, and
   the rotational speed of the drill spindle (30) is higher than the rotational speed of the hammer spindle (6).

2. A rotary hammer according to claim 1, the gear wheels (15, 18) of rotary drive (15, 26) and of additional rotary drive (18, 35) driving the hammer spindle (6) and the drill spindle (30), respectively, are arranged on a common intermediate shaft (17).

3. A rotary hammer according to claim 1 or 2, wherein the gear wheel (35) forming part of the additional rotary drive (18, 35) and non-rotatably connected to the drill spindle (30) is arranged axially in front of

the gear wheel (26) forming part of the rotary drive (15, 26) and non-rotatably connected to the hammer spindle (6).

4. A rotary hammer according to any one of claims 1 to 3, wherein the rotary drive (15, 26) can be deactivated to obtain pure hammer mode.

Patentansprüche

1. Bohrhammer, mit:

(i) einem Bohrhammer-Gehäuse,
(ii) einem Elektromotor (21), der in dem Bohrhammer-Gehäuse vorgesehen ist,
(iii) einer Werkzeug-Halterung (40), die an dem vorderen Ende des Bohrhammer-Gehäuses abnehmbar und unverdrehbar an einem Abschnitt der Hammer-Spindel (6) montiert ist, um ein Hammer-Einsatzwerkzeug (41) mit begrenzter axialer Verlagerung aber unverdrehbar darin aufzunehmen,
(iv) einem in dem Bohrhammer-Gehäuse vorgesehenen Schlag-Mechanismus, um Schläge zu erzeugen, die auf das hintere Ende von einem Hammer-Einsatzwerkzeug (41) wirken, das in der Werkzeug-Halterung (40) eingesetzt ist, und
(v) einem Drehantrieb (15, 26) für die Hammer-Spindel (6),

dadurch gekennzeichnet, daß

koaxial bezüglich des Abschnitts der Hammer-Spindel (6) eine Bohrer-Spindel (30) vorgesehen ist, über deren vorderes Ende hinaus der Abschnitt der Hammer-Spindel (6) vorsteht, der die Werkzeug-Halterung (40) aufnimmt, und an der ein Bohrfutter (42) zur Aufnahme eines Einsatzwerkzeugs (43) ohne axiale Verlagerung abnehmbar und unverdrehbar angebracht werden kann,
die Bohrer-Spindel (30) durch einen zusätzlichen Drehantrieb (18, 35) angetrieben wird, der wirkt, wenn der Elektromotor (21) aktiviert wird, und
die Drehgeschwindigkeit der Bohrer-Spindel (30) größer ist als die Drehgeschwindigkeit der Hammer-Spindel (6).

2. Bohrhammer nach Anspruch 1, bei dem die Zahnräder (15, 18) des Drehantriebs (15, 26) und des zusätzlichen Drehantriebs (18, 35), die die Hammer-Spindel (6) beziehungsweise die Bohrer-Spindel (30) antreiben, an einer gemeinsamen Zwischenwelle (17) angeordnet sind.

3. Bohrhammer nach Anspruch 1 oder 2, bei dem das Zahnrad (35), das einen Teil des zusätzlichen Drehantriebs (18, 35) bildet und unverdrehbar mit der Bohrer-Spindel (30) verbunden ist, in axialer Richtung vor dem Zahnrad (26) angeordnet ist, das einen Teil des Drehantriebs (15,26) bildet und unverdrehbar mit der Hammer-Spindel (6) verbunden ist.

4. Bohrhammer nach einem der vorhergehenden Ansprüche 1 bis 3, bei dem der Drehantrieb (15, 26) deaktiviert werden kann, um die reine Hammer-Betriebsart zu erhalten.

Revendications

1. Un marteau rotatif comprenant :

(i) un carter de marteau,

(ii) un moteur électrique (21) disposé dans le carter de marteau,

(iii) un porte-outil (40) monté à l'extrémité avant du carter de marteau sur une partie de la broche de marteau (6) de manière amovible et solidaire en rotation de ladite partie afin de recevoir une tête de marteau (41) de manière axialement mobile de façon limitée mais non rotative,

(iv) un mécanisme de percussion prévu dans le carter de marteau pour engendrer des impacts agissant sur l'extrémité arrière d'une tête de marteau (41) insérée dans le porte-outil (40), et

(v) un mécanisme d'entraînement en rotation (15, 26) pour la broche de marteau (6),

caractérisé en ce que

- coaxialement par rapport à la partie de la broche de marteau (6) est disposée une broche de foret (30) au-delà de l'extrémité avant de laquelle la partie de la broche de marteau (6) recevant le porte-outil (40) fait saillie et à laquelle peut être fixé, de manière amovible et solidaire en rotation, un mandrin porte-foret (42) servant à recevoir un outil rapporté (43) sans déplacement axial,

- la broche de foret (30) est entraînée par un mécanisme d'entraînement en rotation additionnel (18, 35) qui fonctionne lorsque le moteur électrique (21) est mis en marche, et

- la vitesse de rotation de la broche de foret (30)

est supérieure à la vitesse de rotation de la broche de marteau (6).

2. Un marteau rotatif selon la revendication 1, dans lequel les roues dentées (15, 18) du mécanisme d'entraînement en rotation (15, 26) et du mécanisme d'entraînement en rotation additionnel (18, 35) qui entraînent, respectivement, la broche de marteau (6) et la broche de foret (30) sont montées sur un arbre intermédiaire commun (17).

3. Un marteau rotatif selon la revendication 1 ou 2, dans lequel la roue dentée (35) qui fait partie du mécanisme d'entraînement en rotation additionnel (18, 35) et qui est accouplée de manière solidaire en rotation à la broche de foret (30) est disposée axialement à l'avant de la roue dentée (26) qui fait partie du mécanisme d'entraînement en rotation (15, 26) et est accouplée de manière solidaire en rotation à la broche de marteau (6).

4. Un marteau rotatif selon l'une quelconque des revendications 1 à 3, dans lequel le mécanisme d'entraînement en rotation (15, 26) peut être mis hors service pour obtenir un mode de pur martelage.

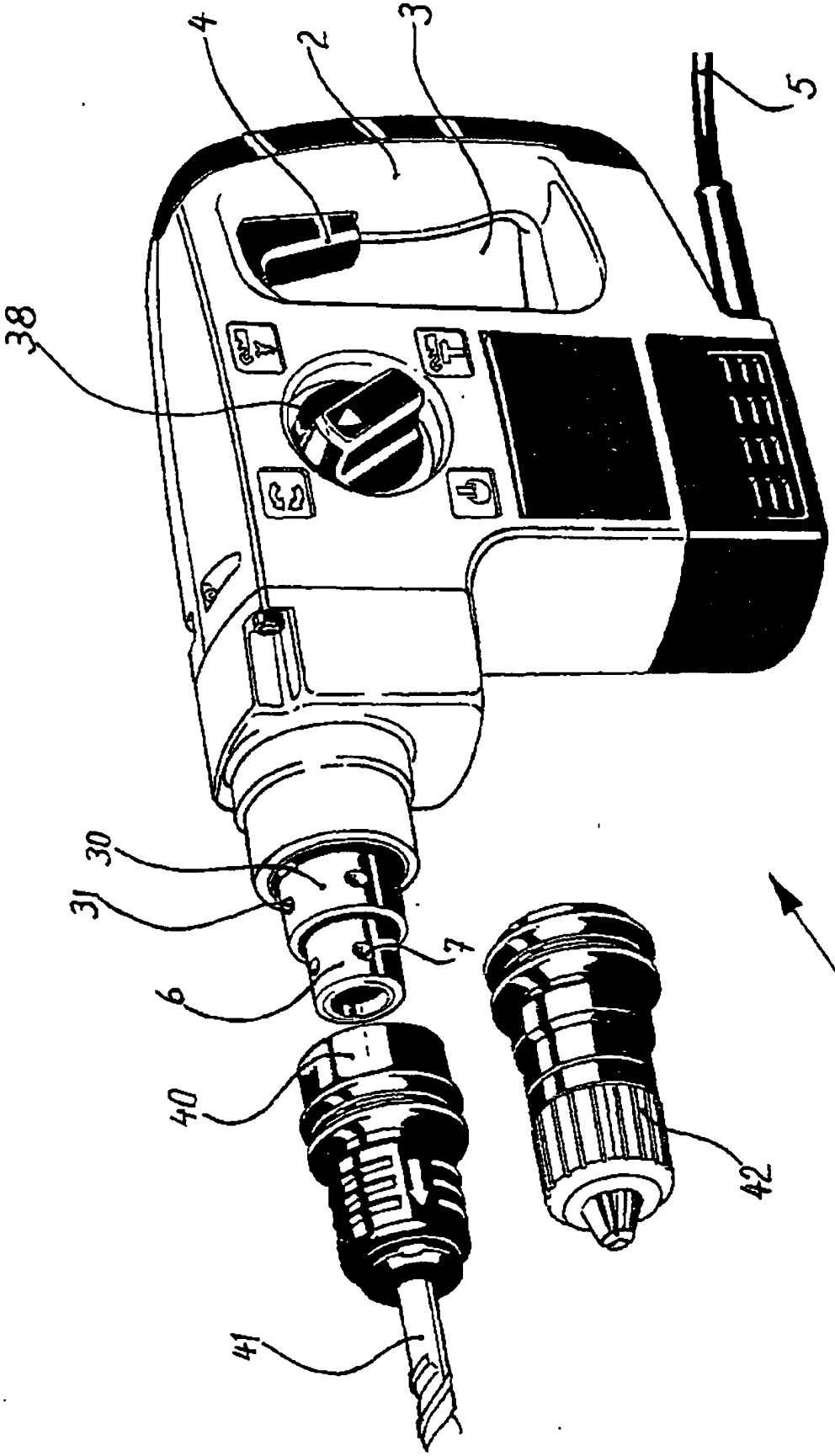

Fig. 1

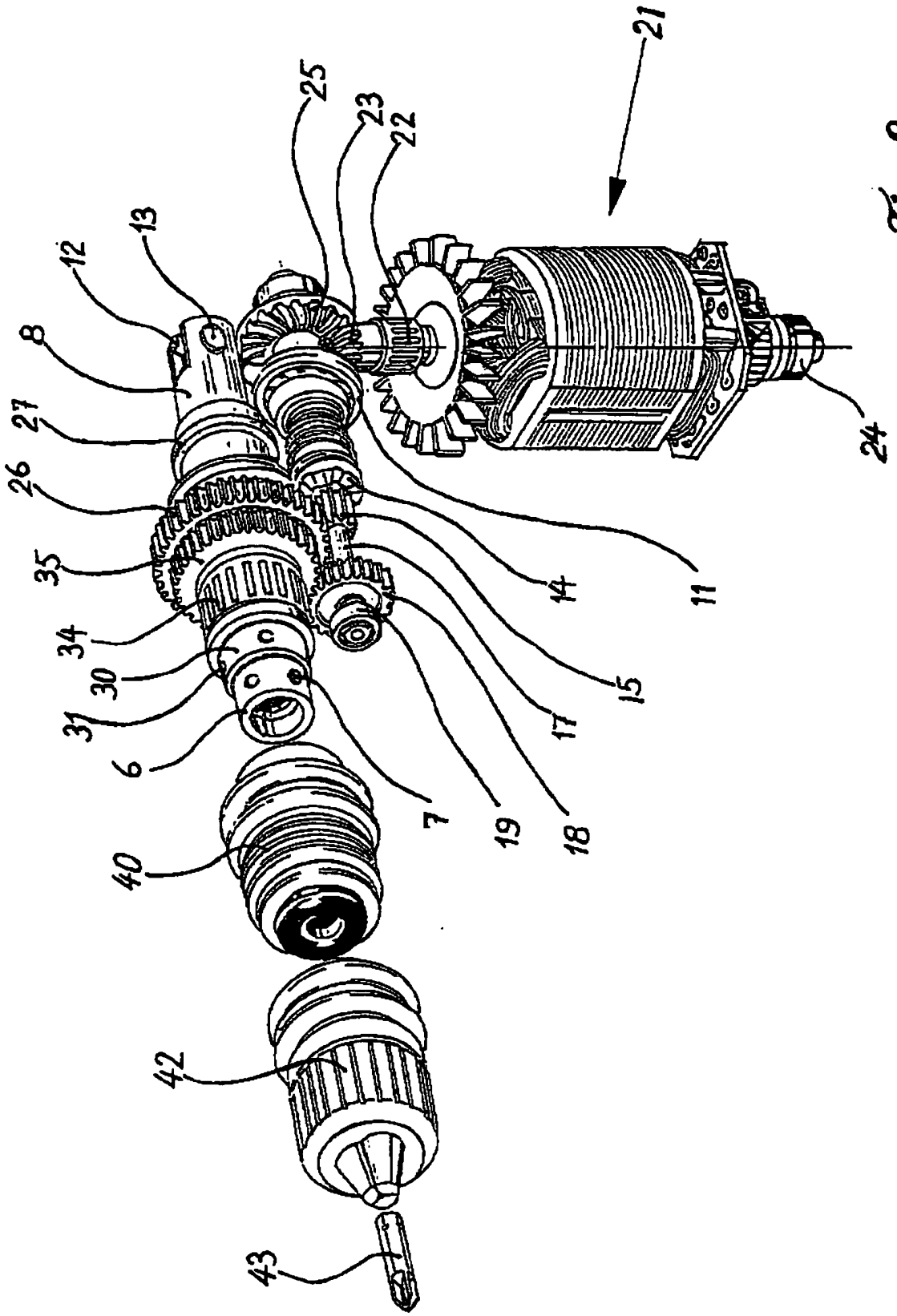

Fig. 2

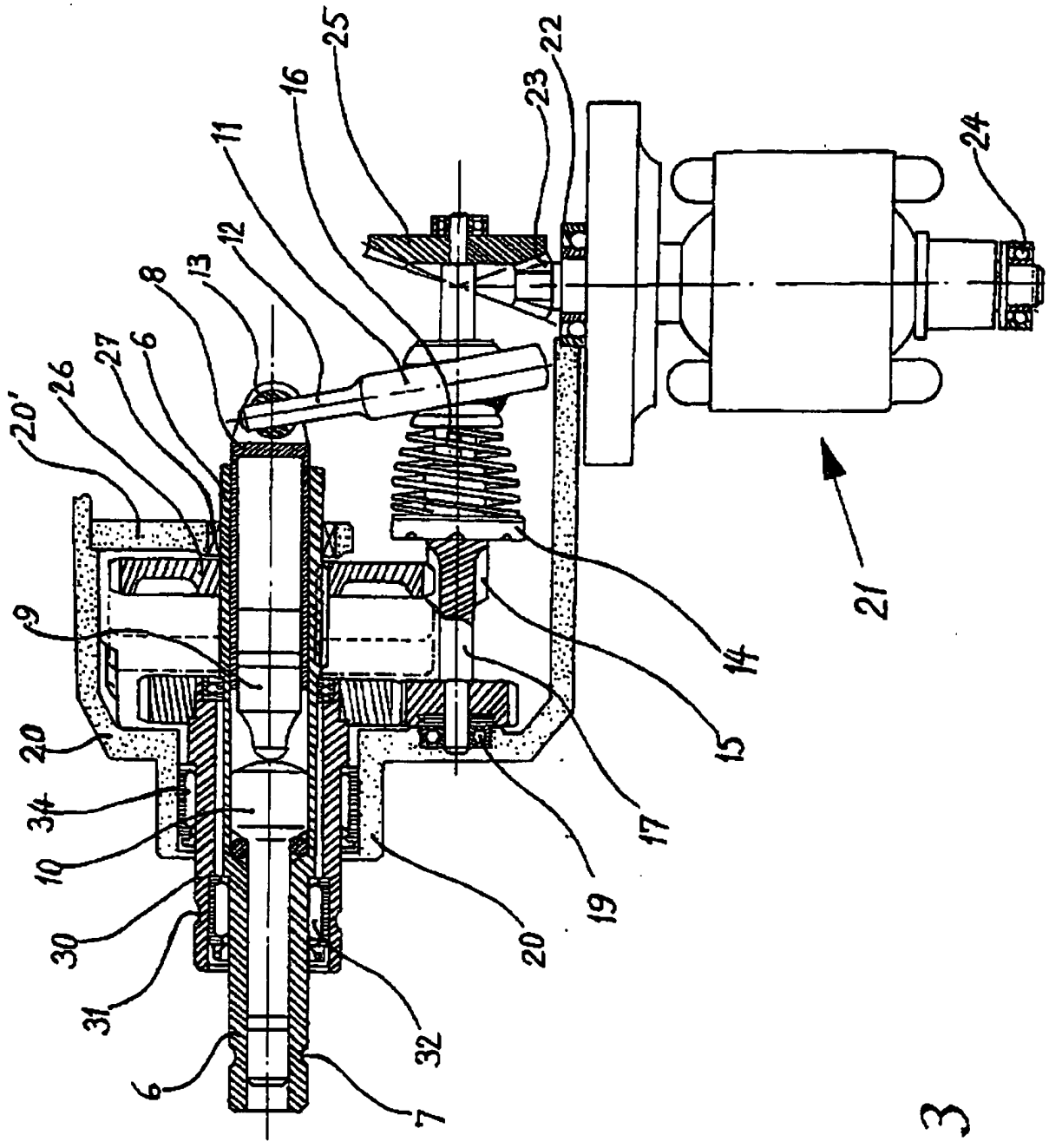
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Fig. 3